pp. 689–694 24 January 1977

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

THE SYSTEMATIC POSITION OF THE MILLIPED FAMILY APTEROURIDAE (DIPLOPODA, CHORDEUMIDA, STRIARIOIDEA) AND A REDESCRIPTION OF *APTEROURUS HORIZONTALIS* LOOMIS[1]

By William A. Shear

Biology Dept., Hampden-Sydney College, Hampden-Sydney, Va. 23943, and American Museum of Natural History, New York, N.Y. 10024.

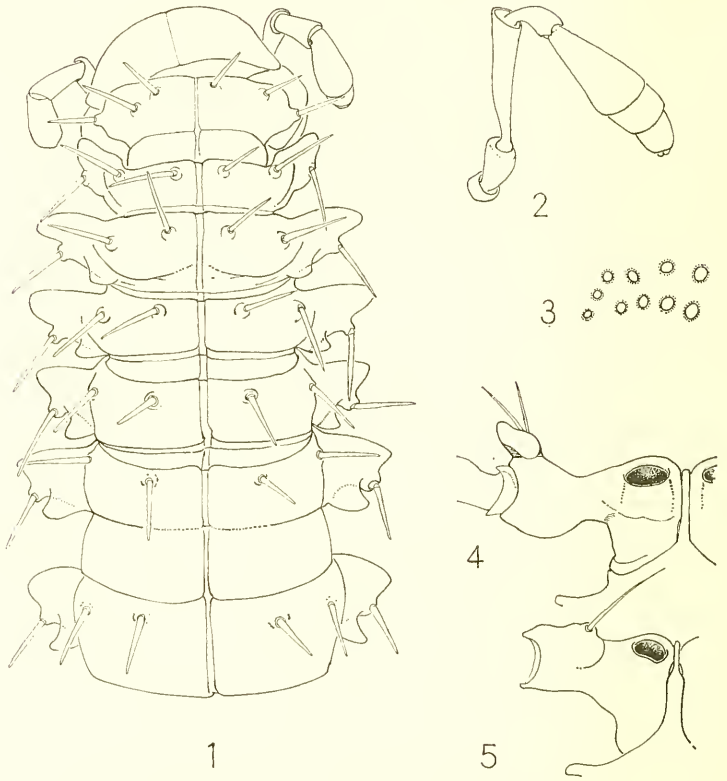
The milliped family Apterouridae and its single included species, *Apeterourus horizontalis*, were described by Loomis (1966) from specimens collected by O. F. Cook in 1929 at Cajon Pass in California. The description unfortunately contained errors, particularly with regard to the structure of the gonopods, and only sketchy figures were presented. The types were evidently misplaced for several years, so that in my monograph of the American chordeumids (Shear, 1972) I was unable to study them and unable to place the family in the larger system. I was finally able to borrow the types through the cooperation of Dr. Ralph Crabill of the National Museum. The retention of *A. horizontalis* in its own monobasic family seems justified at this time in view of its relationships and its unusual combination of primitive and highly evolved characters. The family belongs in the superfamily *Striarioidea*, as defined by me in 1972.

Apterourus horizontalis Loomis
Figures 1–8

Apterourus horizontalis Loomis, 1966:223, figs. 1–4.

Types: Male holotype, male, female and juvenile paratypes from Cajon

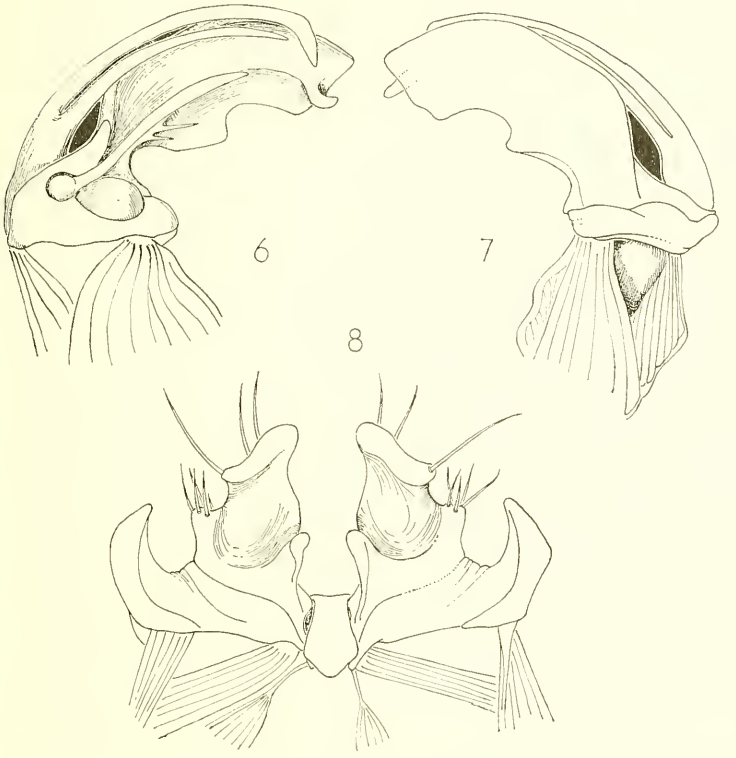
[1] Research supported by a grant to the author from the Mednick Fund, through the Virginia Association of Independent Colleges.



Figs. 1–5. Anatomy of *Apterourus horizontalis*. 1. Head and anterior seven segments of male. 2. Antenna of male. 3. Left eyepatch of female (anterior to the left). 4. Coxae 10 of male, ventroposterior view. 5. Coxae 11 of male, ventroposterior view.

Pass, 7 miles west of Cajon on Big Pine Road, San Bernardino Co., California, collected 14 February 1929 by O. F. Cook, deposited in USNM (myriapod collection No. 3159), examined.

Description: Male holotype and male paratype with body form as described by Loomis (1966), the following features of particular importance. About 7 mm long. Collum (fig. 1) convex, posterior margin incurved, outermost seta on short prominence, collum partly covering head. Segments (fig. 1) nearly circular in cross section, with flaring, broad, thin, winglike paranota projecting from lateral midpoints. Paranota at first angled forward, but more posterior ones projecting straight



Figs. 6–8. Anatomy of *Apterourus horizontalis*. 6. Left anterior gonopod, mesial view. 7. Same, lateral view. 8. Posterior gonopods (legpair 9), anterior view.

laterad, two-lobed; outer lobe thick, anteriorly somewhat rimmed, bearing outermost segmental seta midway on its posterior margin; inner lobe projecting from near posterior base of outer lobe, thin, translucent, absent from second segment, becoming prominent on more posterior segments. Paranota reduced in size from segment 7 to segment 24, absent from segments 25–30. Mentum of gnathochilarium divided, antennae (fig. 2) strongly clavate. Eyes much reduced, 4–5 unpigmented ocelli hardly detectable in male. Legs 3–7 crassate, declining in size from anterior to posterior, legpair 3 largest, prefemur slightly swollen and with slight posterior depression.

Gonopods (figs. 6,7) in socket with high lateral rims, closely appressed in midline, sternum more or less completely divided. In lateral view

(fig. 7), lateralmost coxite broad, flat, evenly curved, narrowed at base, only partially concealing divided flagelliform mesal coxite. Lateral sternal sclerite smooth, heavily chitinized. In mesal view (fig. 6) lateral coxite with mesial ridge bearing two short, pointed branches basally and large blunt hook distally, otherwise thin. Mesial coxite with two evenly curved flagelliform branches. Articulated coxal flagellum located near mesial posterior base of coxal region; telopodite reduced to small, low, rounded swelling.

Posterior gonopods developed from ninth legs (fig. 8). Sternum complete, with large flared regions laterally; coxae immovable, fused to sternum, articulating in midline with knoblike sternal sclerite. Teleopodites lobed and setose, anteriorly concave, as shown.

Coxae of legpair 10 (fig. 4) enlarged, with gland, and mesioapical knob bearing two strong setae; coxae 11 somewhat similar but not so strongly modified (fig. 5).

Female: Similar in nonsexual characters to male described above, but body somewhat more robust. Eyes as in fig. 3. Cyphopods large, protruding, possibly permanently extended, posterior margin of cyphopod socket formed from sternite of segment 3.

Distribution: Known only from the type-locality.

Discussion: Loomis (1966) failed to dissect either of the males available to him thoroughly enough to find the ninth legs, thus he erroneously stated that the gonopods were formed from the eighth legs and that the ninth legs were essentially similar to those that followed. Under the family description, Loomis wrote that the "eleventh" coxae were "perforate," a statement which is not consistent with his interpretation of the gonopods, since if the tenth legs were thought by him to be the ninth, the "eleventh" legs he described should actually have been the twelfth, which do not bear a coxal gland. No mention is made of a gland opening on the coxae of the "tenth" (actual eleventh) legs, nor on the "ninth" (actual tenth) legs. In fact, both the tenth and eleventh pairs of legs have coxal glands. Loomis missed the real ninth legs entirely since they are usually reduced and completely concealed in situ by the anterior gonopods. This misinterpretation of the gonopods was what made the Apterouridae impossible to place in the larger picture of the Order Chordeumida, without examining specimens.

The gonopod anatomy clearly links this family to the Striariidae, Urochordeumidae, Rhiscosomididae and Caseyidae, which, taken together, make up the superfamily Striarioidea (Shear, 1972). Members of the superfamily have a divided mentum, 30 segments, and gonopods with two or more coxites, one of which is frequently movable, and flagelliform. The posterior gonopods (ninth legs) are generally reduced but retain in most species at least one separate telopodite segment; the tenth legs bear coxal glands. While agreeing with the other families in most ways, there are some differences in *A. horizontalis*. The eleventh coxae have gland openings, suggesting the Superfamily Brannerioidea, a related but

perhaps more primitive group; Loomis (1966) indirectly suggested membership in the Brannerioidea by relating the Apterouridae to the Tingupidae. Other members of the superfamily Striarioidea also have a rather prominent, lobelike gonopod telopodite, while in *Aperourus horizontalis* the gonopod telopodite is very much reduced and appears only as a smooth mound on the posterior surface of the gonopod. The ninth legs are also very much reduced, with the coxae fused to the sternum.

These differences are not of sufficient importance to place *A. horizontalis* outside the Superfamily Striarioidea, since all of them simply represent stages in reduction of various characters which are duplicated in kind in other superfamilies of millipeds.

Among the other families in Striarioidea, Apterouridae seem closest to another monobasic, little known family, Urochordeumidae, which it resembles in gonopod plan and body form. However, urochordeumid species are much larger, have far more prominent, flat paranota, giving an almost polydesmoid appearance, and have an extensive suite of pregonopodal leg modifications not found in *Apterourus*. The most primitive known chordeumids are the Heterochordeumatidae of Southeast Asia (Hoffman, 1963). Members of this family have broad paranota and are very much like platydesmids in general form. The gonopods are leglike, not strongly modified. Taking this as evidence it is likely that the primitive body form in the Chordeumida was flat, with prominent paranota. Among the Striarioidea, the Urochordeumidae have a flat body with broad paranota and therefore may be the most primitive of this subfamily. The Apterouridae and Rhiscosomididae have segments that are rounder in cross section but retain paranota—much broader in the Rhiscosomididae. In the Striariidae, the paranota are reduced and the body is heavily armored for burrowing, while the Caseyidae have lost all trace of paranota and are quite cylindrical. Paranota are probably an adaptation for forcing a way between layers of leaf litter, while the cylindrical body form gives extra power and protection for burrowing.

Thus the Order Chordeumida may have originated as a group of leaf-litter dwelling species which later radiated to other habitats, including those which required a body form adapted to burrowing. The trend has been reversed in a few species of Cleidogonidae, most Conotylidae and in Trichopetalidae, in which relatively large "paranota" have been formed from the basal tubercles of the segmental setae. These secondary developments are not thin and platelike and bear the segmental setae in different positions than in the Striarioidea.

Literature Cited

Hoffman, R. L. 1963. Notes on the structure and classification of the diplopod family Heterochordeumatidae. Ann. Mag. Nat. Hist. 6:129–135.

Loomis, H. F. 1966. Two new families and other North American Diplopoda of the Suborder Chordeumida. Proc. Biol. Soc. Washington, 79:221–230.

Shear, W. A. 1972. Studies in the milliped Order Chordeumida (Diplopoda): A revision of the Family Cleidogonidae and a reclassification of the Order Chordeumida in the New World. Bull. Mus. Comp. Zool. 114(4):151–352.